

Neighborhood Stress and Violent Crime

Enhancing the Pima County, AZ
Indicators of Neighborhood Stress
Map with City of Tucson
Violent Crime Data

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Data: Wikipedia

Overview

- Goals + Motivations
- Background
 - History
 - Geographic Context
- Data + Methods
 - Neighborhood Stress Maps
 - Violent Crime Map
 - Composite Stress Map
- Conclusions + Future Directions



What's neighborhood stress?

- Socio-economic or housing conditions that could be improved with funds
 - Unemployment rate
 - Poverty rate
 - Neighborhood instability
 - Vacancy rate
 - Non-affordable housing
 - No vehicle



Goals + Motivations

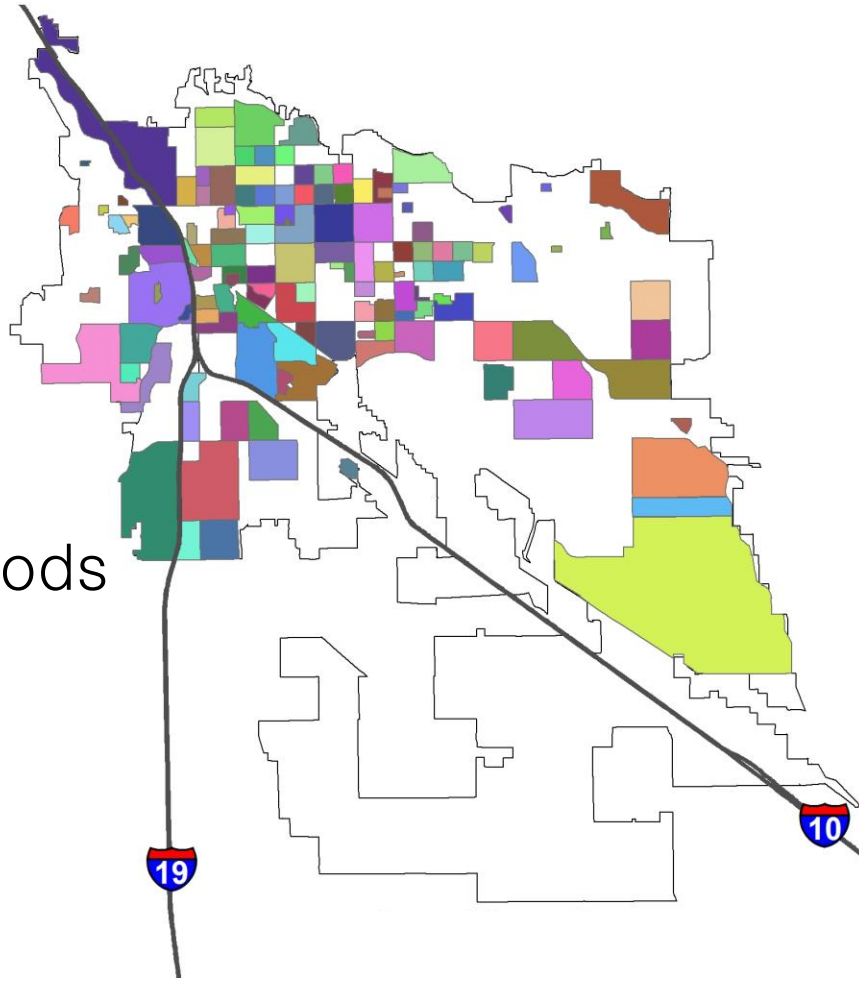
1. Automate creation of Pima County and Tucson neighborhood stress maps
 - Current stress maps are hard to find
 - Time consuming to create
2. Create violent crime map for Tucson
 - Other measures of stress
3. Augment Tucson neighborhood stress map with violent crime
 - More complete picture of stress

History

- ID neighborhoods with socio-economic or shelter issues – “stressed” areas
- Direct funding to high stress areas
- No measures of stress or ways to compare neighborhood stress levels

Tucson Neighborhoods

- 134 neighborhoods



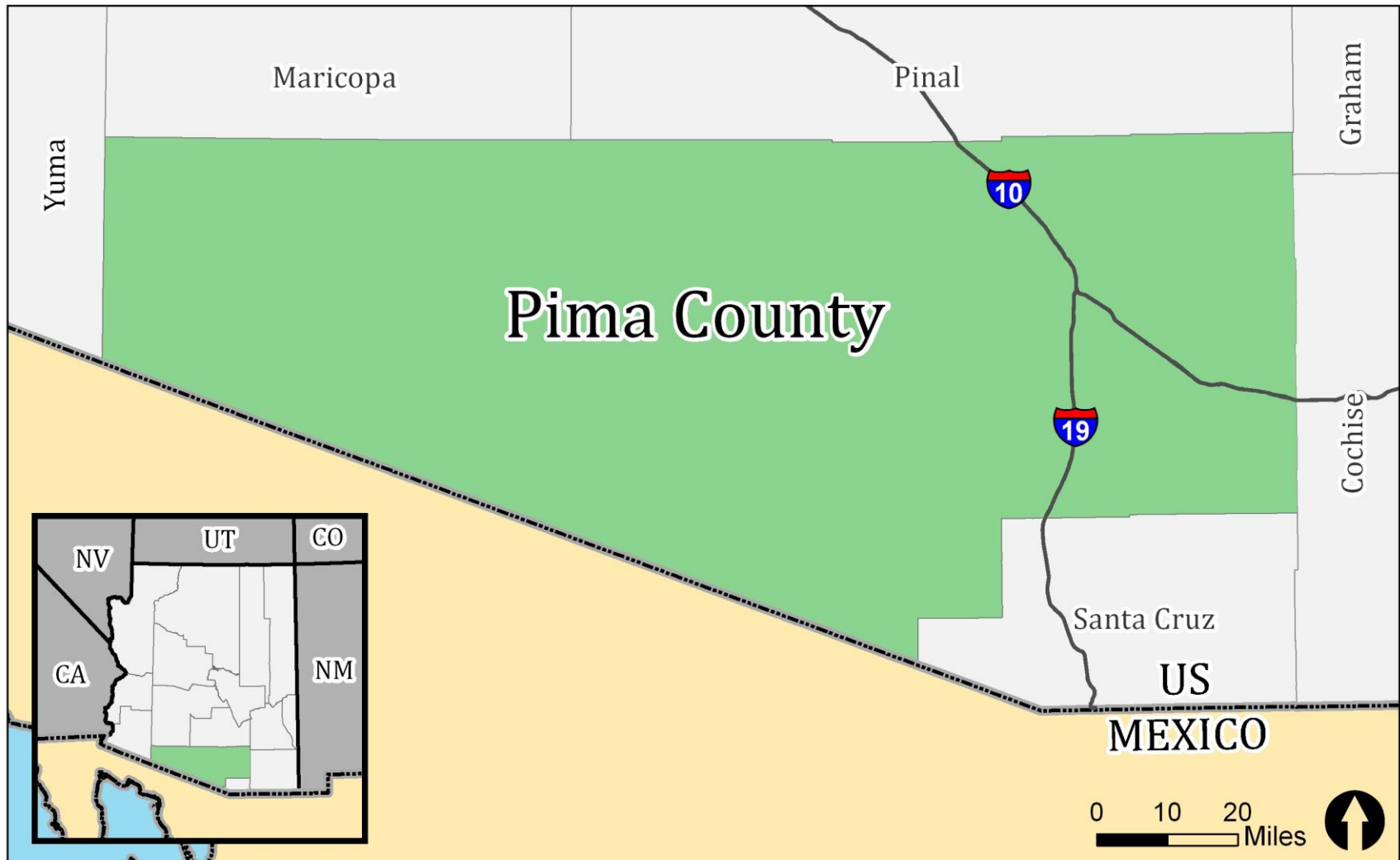
History

- Free, regularly updated, accessible, neighborhood scale data
- Stress indicators chosen from long-form 1980 US Census
- Compare indicator scores of tracts to the area mean – relative scoring
- 2000 – 27 indicators
- 2006 to present – 26 indicators

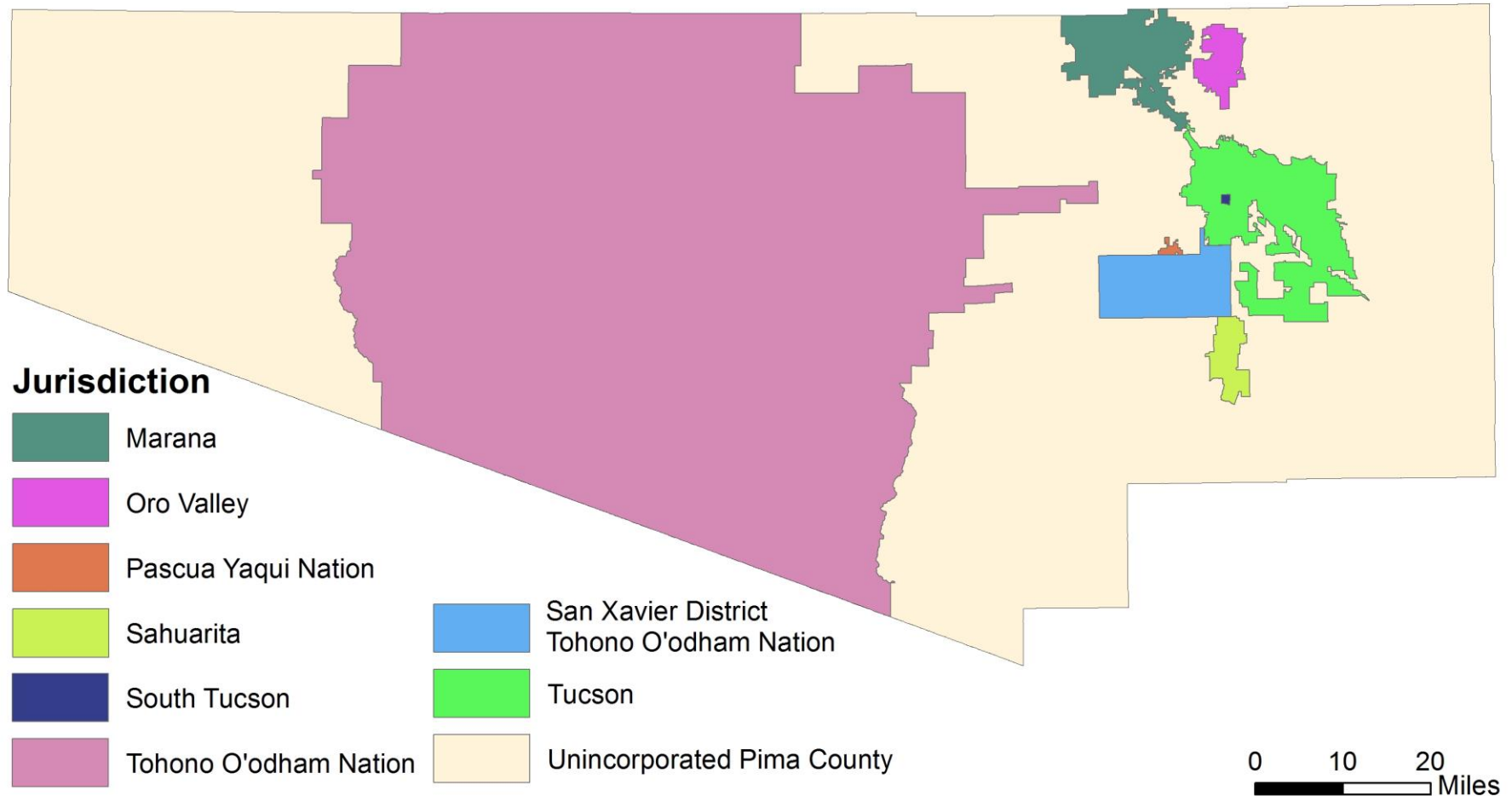
History

- Example indicators:
 - Housing units which have more than 1.01 persons per room as a percentage of all occupied housing units.
 - Households in which all persons 14 years of age and over have at least some difficulty speaking English as a percentage of all households
 - Females 16 years and over who are in the labor force and have children under 6 years of age as a percentage of all females 16 years and over with children under 6 years of age
 - Housing units built before 1940 as a percent of all housing units

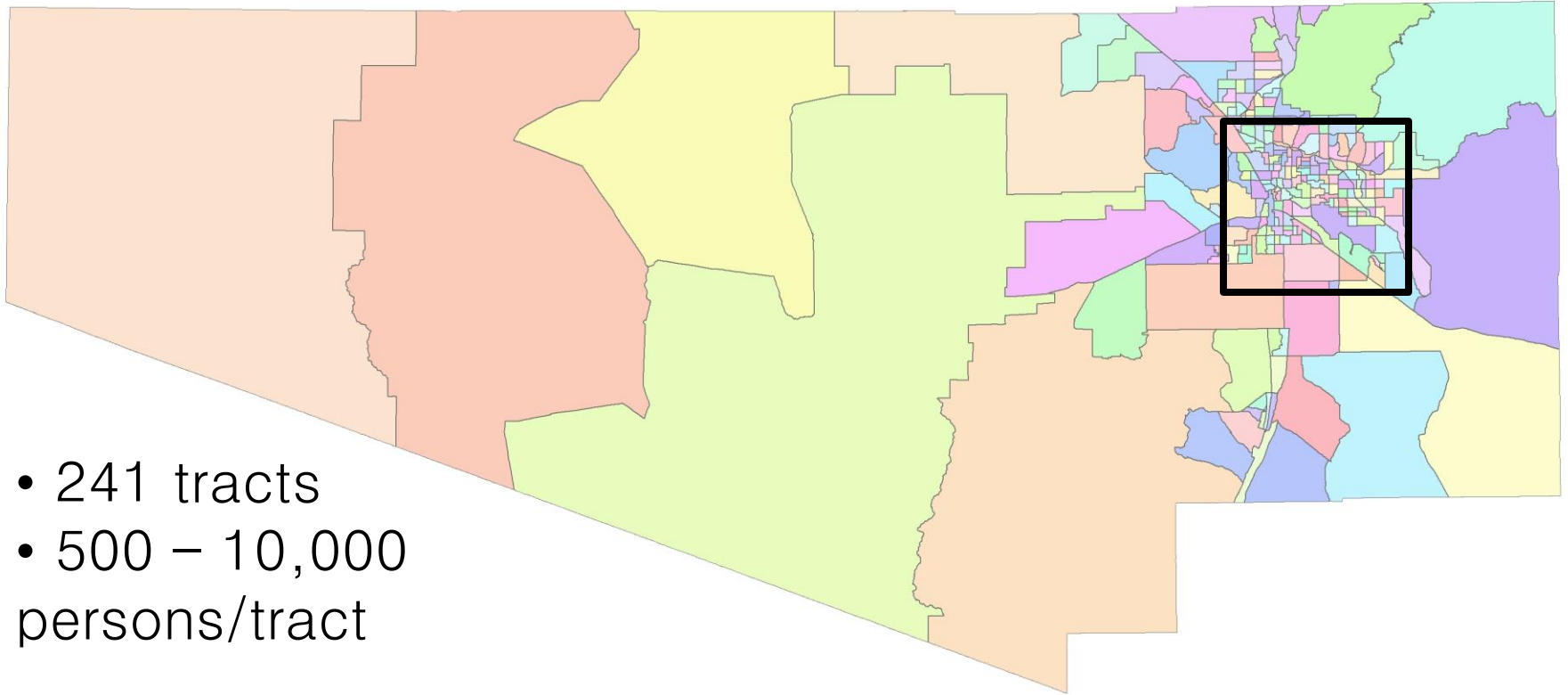
Geographic Context



Major Jurisdictions

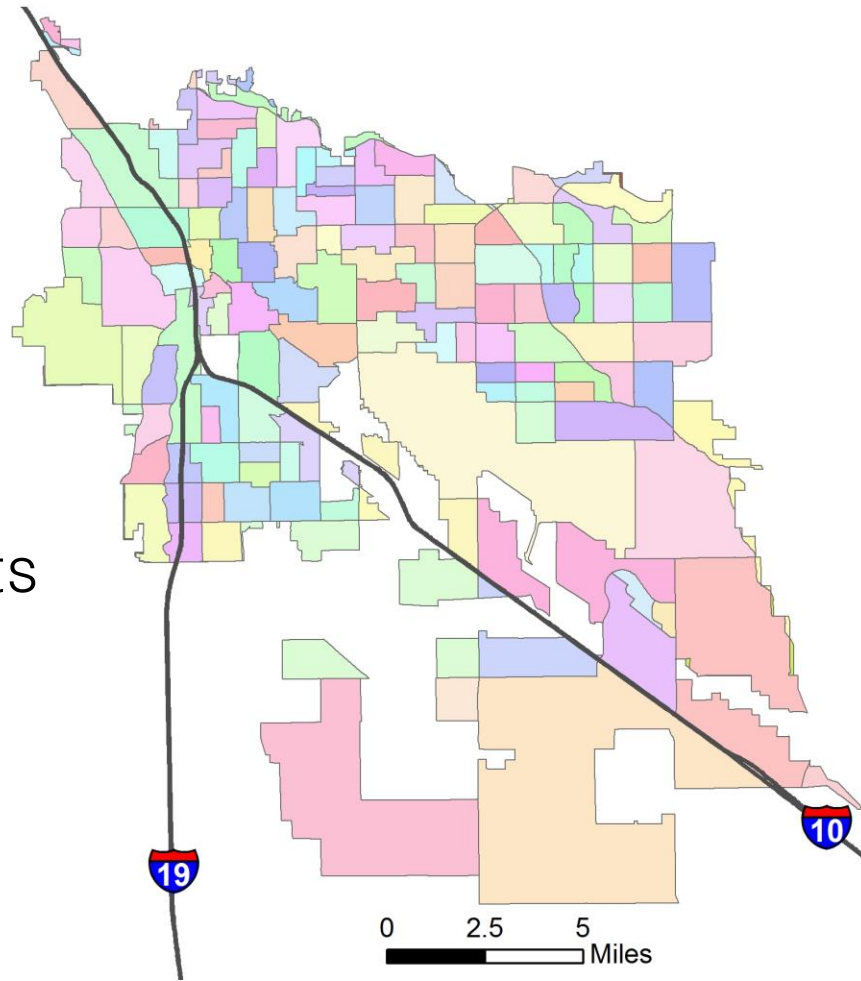


Pima 2010 Census Tracts



Tucson 2010 Census Tracts

•152 tracts



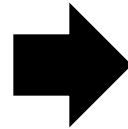
American Community Survey Data

- Starting in 2005, 5-year ACS used for stress map
- ACS surveys small sample of population, then extrapolates
 - Done each year for places +65k people
- 5-year rolling average, not point
 - 2006–2010: average over 5 years

Neighborhood Stress Map Data

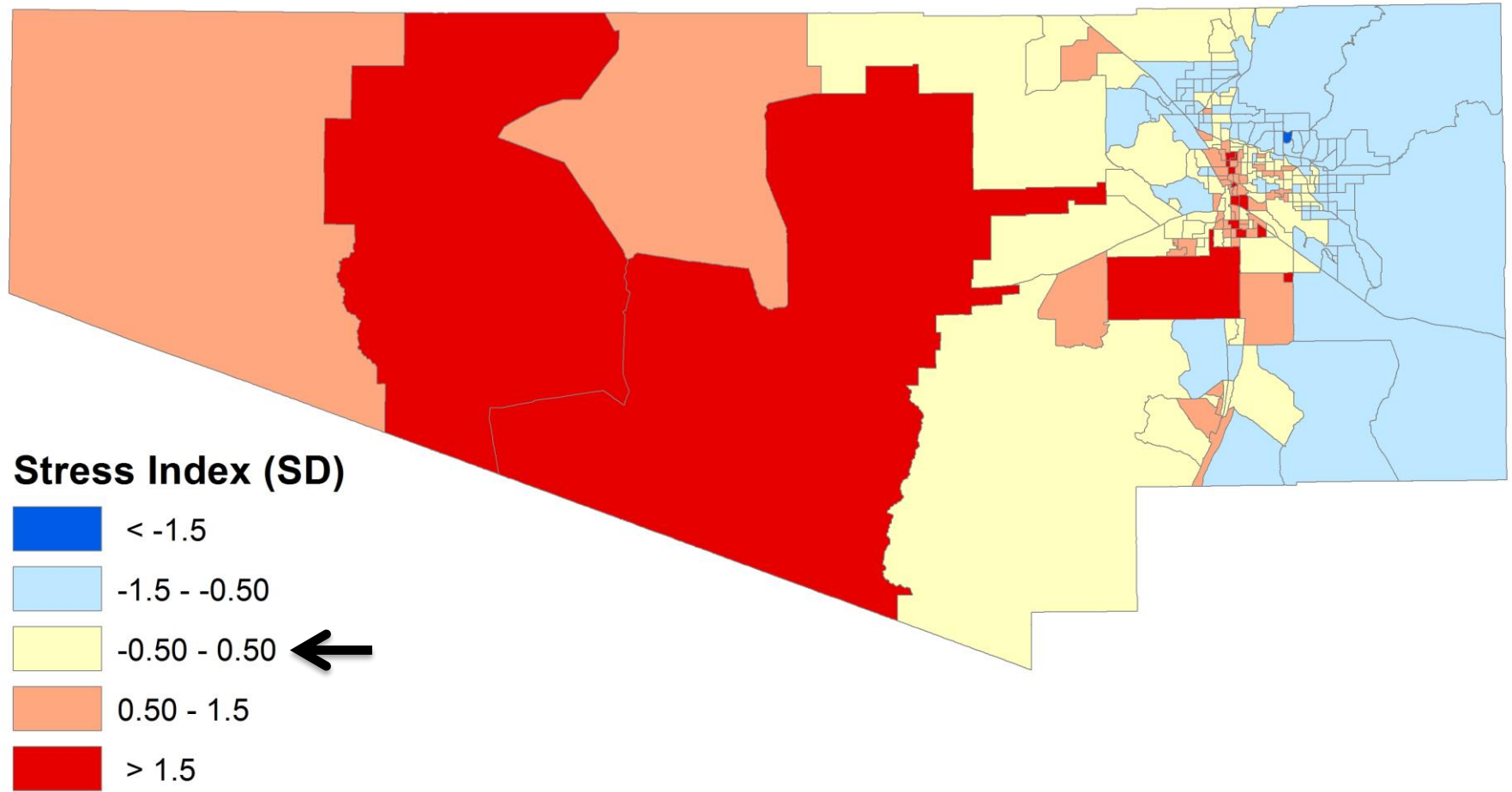
- Compare indicators amongst census tracts to the area mean
- Calculate standard score (z-score)
 - Example: i01: % population under 17 years

$$(i01x - i01\mu) / i01\sigma$$

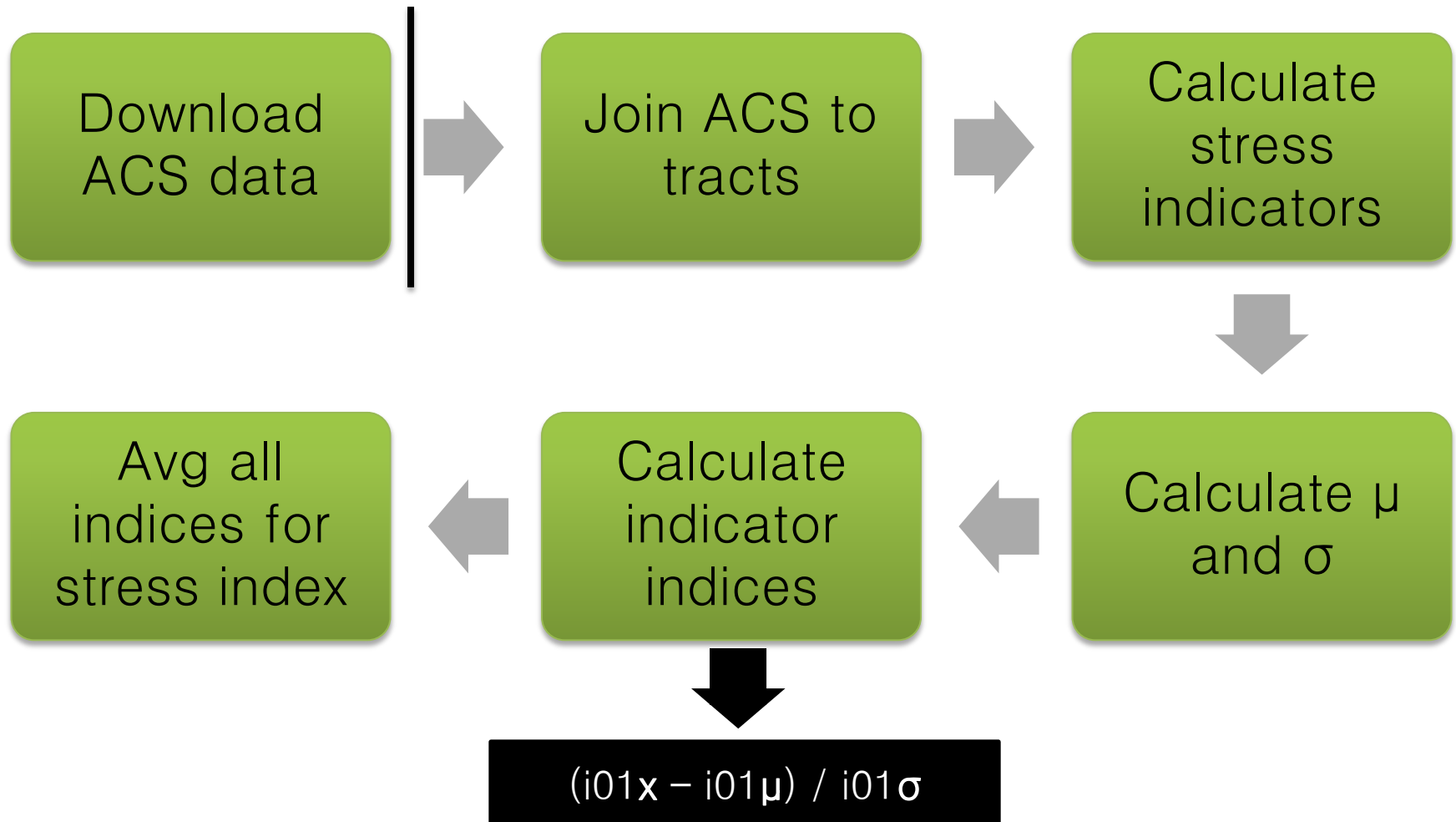


$$(10 - 5) / 5 = \textcircled{1}$$

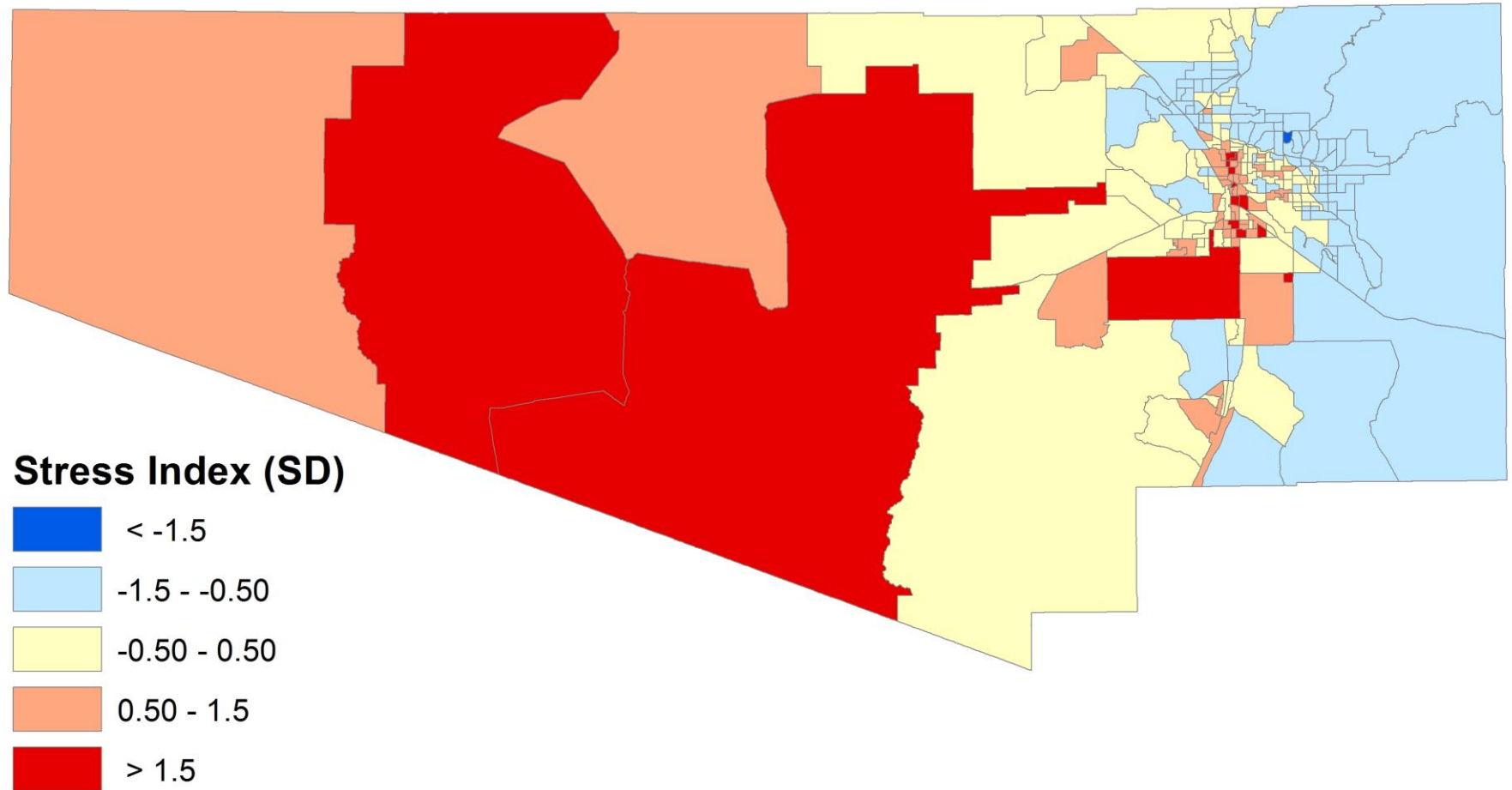
Pima County Stress (2006–2010)



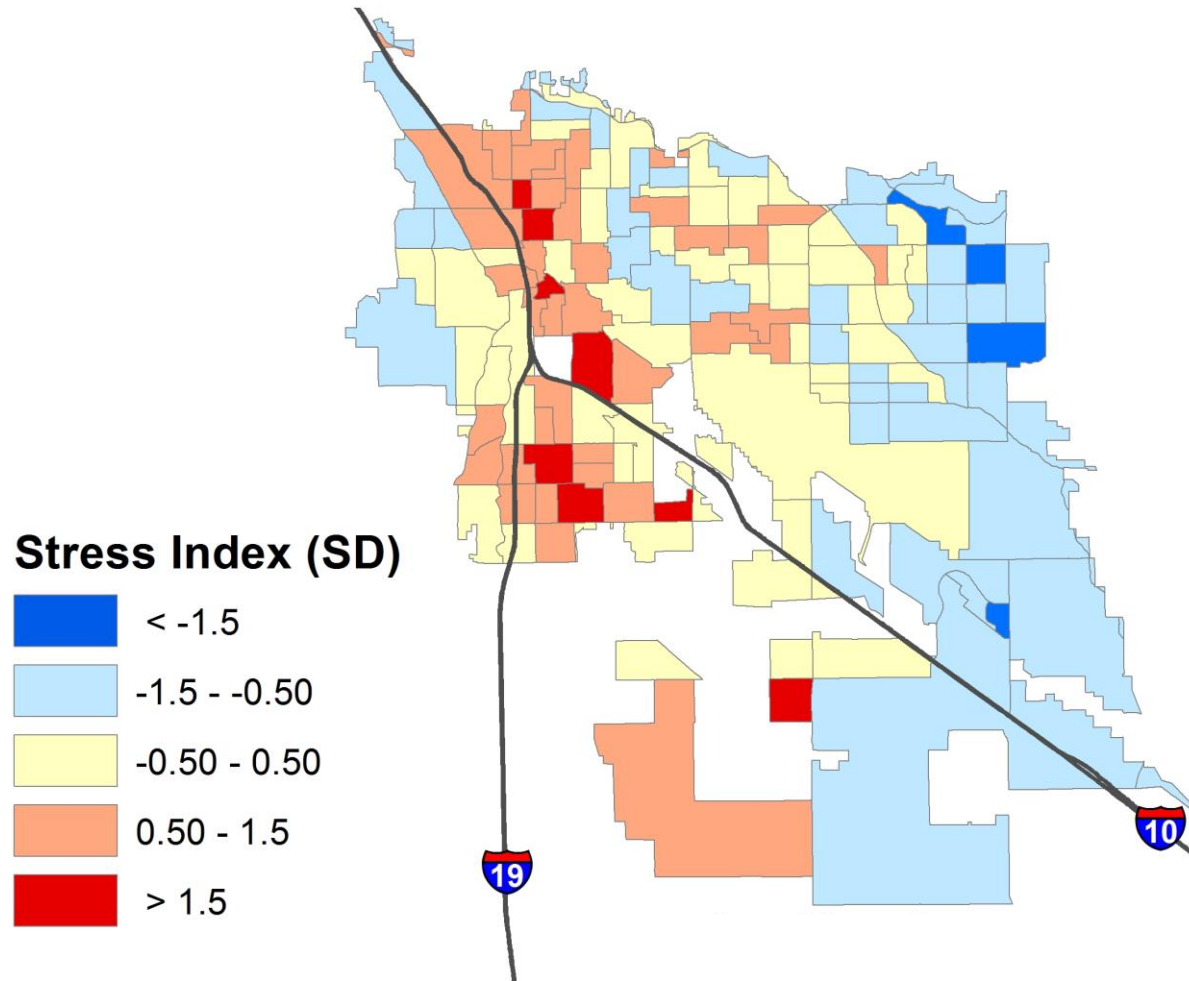
Neighborhood Stress Map Creation



Pima County Stress (2006–2010)



Tucson Stress (2006–2010)

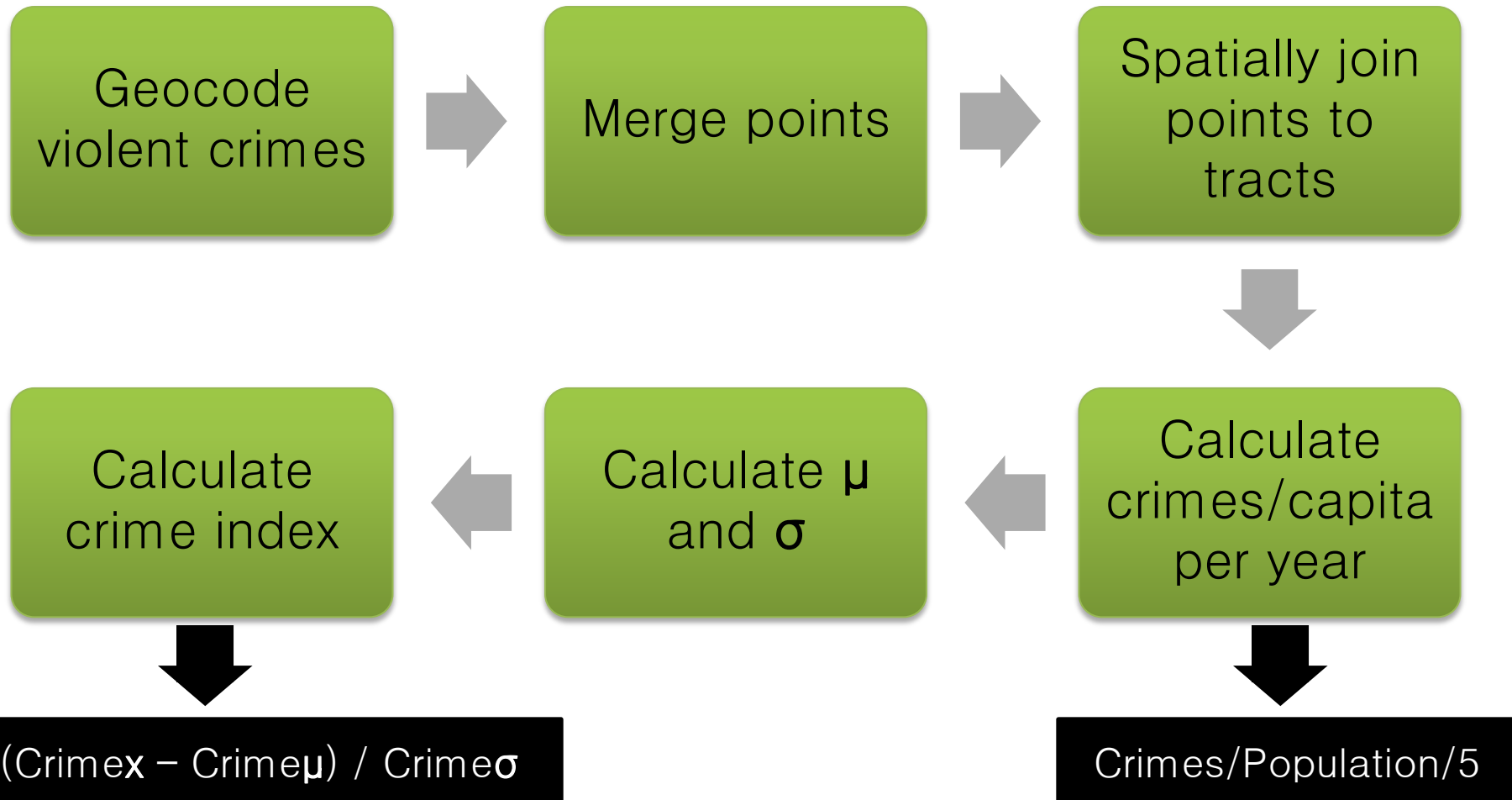


Violent Crime Map Data

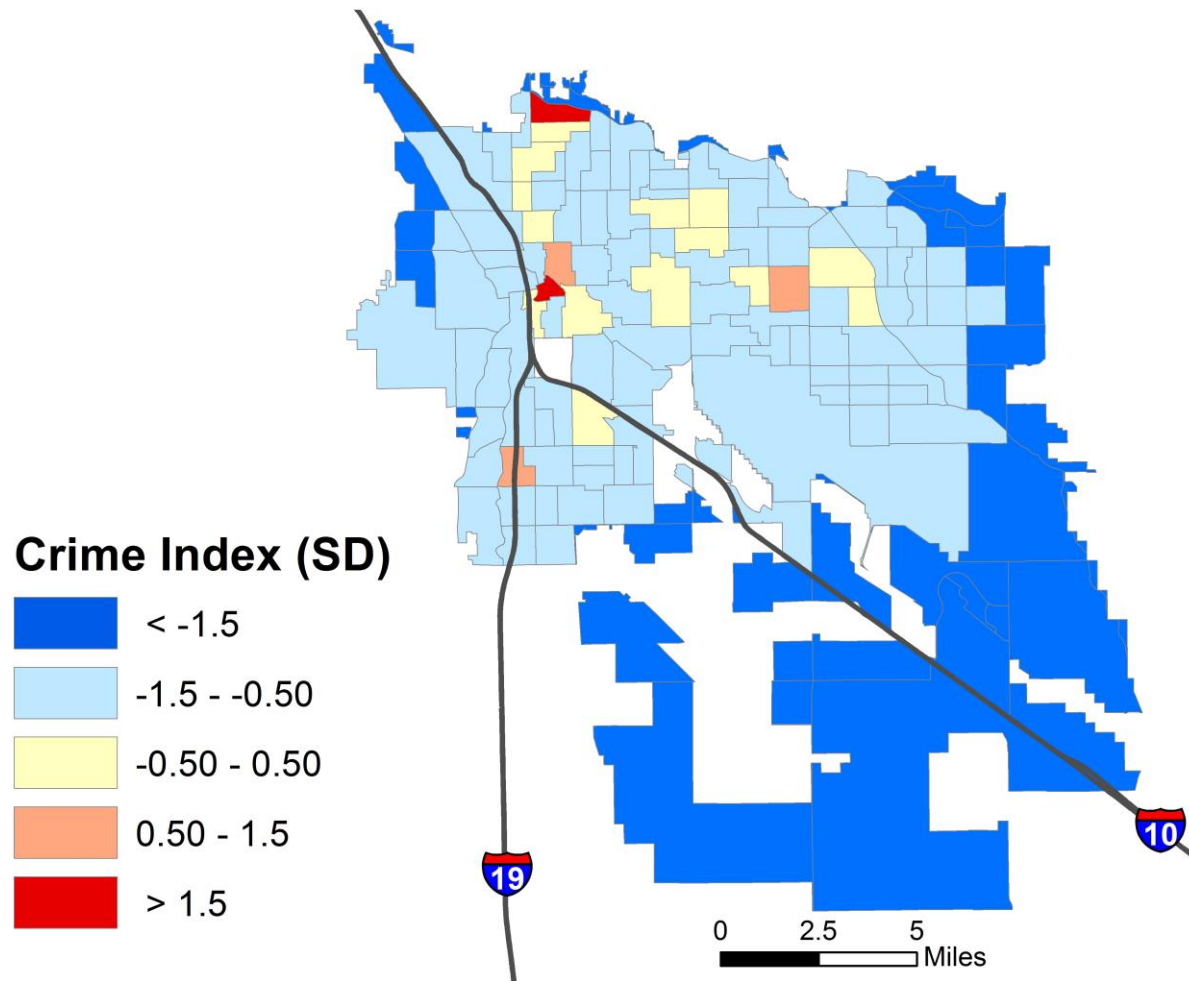
- Violent crimes/capita/year for Tucson
 - Average for 2006–2010
- Violent crime:
 - Criminal Homicide
 - Forcible Rape
 - Robbery
 - Aggravated Assault
 - Burglary
 - Larceny–theft (no shoplifting)
 - Motor Vehicle Theft
 - Arson



Violent Crime Map Creation

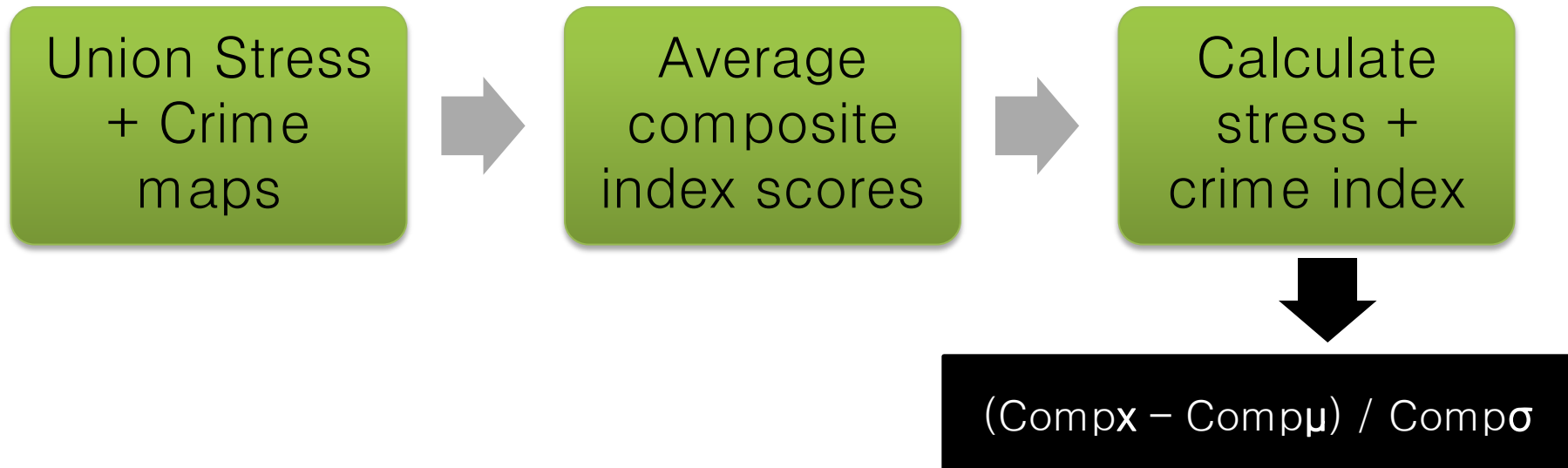


Tucson Violent Crime (2006–2010)

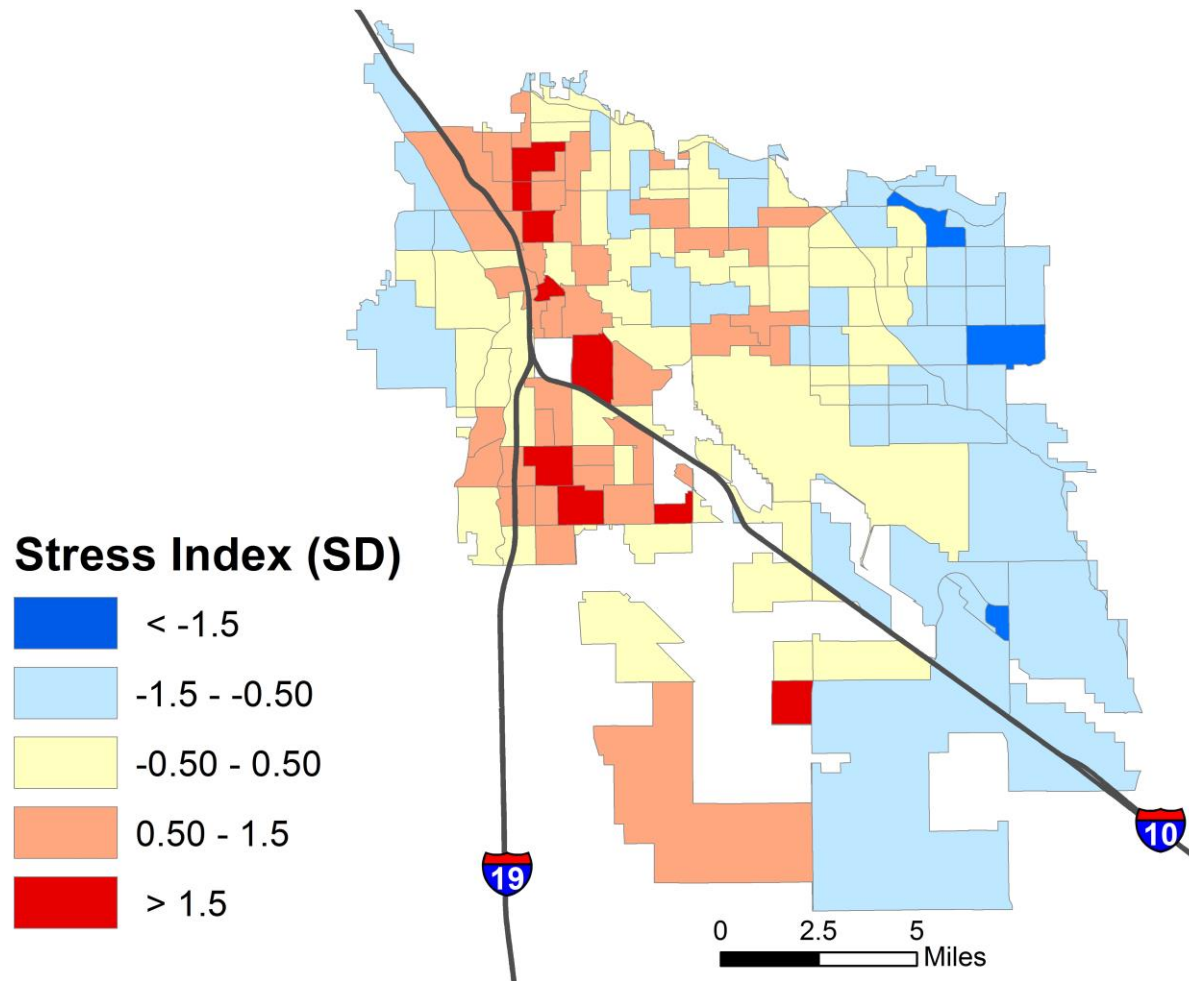


Data: American Community Survey; Pima County GIS Library; Tucson Police Dept.

Composite Stress Map Creation



Composite Stress (2006–2010)



Conclusions

- More stress/crime:
 - Tohono O'odham Nation, Oracle alignment
- Less stress/crime:
 - Marana, Oro Valley, Foothills
- 1st stage of much larger, more complex stress model



Future Directions

- Online
 - More accessible
 - More data
- Environmental stress
- Crime data and modeling
- ACS Margin of error index
 - Less population = less certainty



Acknowledgements

- Dave Taylor
- Anna Sanchez
- Dr. David Plane



Thank you!

Questions?

References

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Auxiliary Slides

New Indicator	ACS Table	Equation	Old Indicator # and Name	Description
i01	DP05	100-HC03_VC23	1. Minor Population	Persons 17 years old or less as a percentage of the total population.
i02	DP05	HC03_VC26	2. Elderly Population	Persons aged 65 years or more a percentage of the total population.
i03	DP05	HC03_VC07	3. Pre-School Proportion	Children 4 years or less as a percentage of the total youth population aged 17 years or less.
i04	S0101	HC01_EST_VC37	4. Dependency Index	Ratio of youths (17 years or less) and elderly (65 years or more) to working age persons (18 – 64 years).
i05	S1602	HC01_EST_VC03	6. Linguistic Isolation	Households in which all persons 14 years of age and over have at least some difficulty speaking English as a percentage of all households.
i06	S1701	HC03_EST_VC01	8. Poverty Status - Persons	Persons below the poverty level as a percentage of all persons for whom poverty status is ascertained.
i07	B01001	(HD01_VD03+HD01_VD27)/(HD01_VD30+HD01_VD31+HD01_VD32+HD01_VD33+HD01_VD34HD01_VD35+HD01_VD36+HD01_VD37+HD01_VD38)	5. Fertility Index	Number of children less than 5 years of age per 1,000 women aged 15 to 44 years of age.
i08	S1702	HC02_EST_VC01	9. Poverty Status - Families	The number of families below the poverty level as a percentage of all families for whom poverty status is ascertained.
i09	S1701	HC03_EST_VC06	10. Poverty Status - Elderly Persons	Persons 65 years or over who are below the poverty level as a percentage of all persons 65 years or over.
i10	S1501	HC01_EST_VC08 + HC01_EST_VC09	11. Educational Attainment	Persons aged 25 years and over who have completed less than 4 years of high school as a percentage of all persons 25 years and over.
i11	S2301	((HC04_EST_VC01 * .01)*HC01_EST_VC01)/((HC02_EST_VC01*.01)*HC01_EST_VC01)	12. Unemployment Rate	Unemployed persons 16 years and over who are in the civilian labor force as a percentage of all persons 16 years and over in the labor force.

New Indicator	ACS Table	Equation	Old Indicator # and Name	Description
i12	S2303	HC01_EST_VC08	13. Not Working in 1999	Persons 16 years and over with no employment in 1999 as a percentage of all persons 16 years and over.
i13	S2301	HC02_EST_VC28	14. Working Mothers	Females 16 years and over who are in the labor force and have children under 6 years of age as a percentage of all females 16 years and over with children under 6 years of age.
i14	DP02	(HC01_VC12/HC01_VC06)*100	15. Female Householder	Families who have a female householder with related children under 18 with no husband present as a percentage of all families with related children under 18 years of age.
i15	DP04	HC03_VC72	16. Neighborhood Instability	Number of head of households that moved into the current dwelling less than 5 years ago as a percentage of all occupied housing units.
i16	DP04	100-HC03_VC110	17. Crowding	Housing units which have more than 1.01 persons per room as a percentage of all occupied housing units.
i17	B25050	(HD01_VD16 / HD01_VD01) *100	18. Sanitation/Crowding	Housing units that lack plumbing for exclusive use and which have more than 1.01 persons per room as a percentage of all occupied housing units.
i18	DP04	HC01_VC103	19. Plumbing	Housing units that lack plumbing for exclusive use as a percentage of all housing units.
i19	DP04	HC03_VC34	20. Housing Age	Housing units built before 1940 as a percent of all housing units.
i20	DP04	HC01_VC104	21. Kitchen Facilities	Housing units which lack complete kitchen facilities as a percent of all housing units
i21	DP04	HC03_VC93 + HC03_VC94 + HC03_VC95 + HC03_VC98	22. Heating Fuel	Occupied housing units lacking adequate heating fuels, i.e., that use fuel oil or kerosene, wood, coal, or no fuel at all, as a percentage of all occupied housing units.
i22	DP04	HC03_VC05	23. Vacancy Rate	Vacant housing units as a percentage of all housing units.
i23	S2503	HC03_EST_VC37	24. Owner Costs	Owner households with incomes less than \$20,000 with owner costs exceeding 34% of their income as a percentage of specified owner occupied housing units.
i24	B25074	((HD01_VD06 + HD01_VD07 + HD01_VD13 + HD01_VD14)/HD01_VD01) * 100	25. Renter Costs	Renter households with incomes less than \$20,000 with gross rent exceeding 34% of their income as a percentage of specified renter occupied housing units.
i25	B25043	((HD01_VD10 + HD01_VD19)/HD01_VD01) * 100	26. Communications	Occupied housing units with no telephone and with a householder aged 65 years or over as a percentage of all occupied units.
i26	DP04	HC03_VC82	27. Access	Occupied housing units with no vehicle available as a percentage of all occupied units.

- **Criminal homicide** —a.) Murder and nonnegligent manslaughter: the willful (nonnegligent) killing of one human being by another. Deaths caused by negligence, attempts to kill, assaults to kill, suicides, and accidental deaths are excluded. The Program classifies justifiable homicides separately and limits the definition to: (1) the killing of a felon by a law enforcement officer in the line of duty; or (2) the killing of a felon, during the commission of a felony, by a private citizen. b.) Manslaughter by negligence: the killing of another person through gross negligence. Traffic fatalities are excluded.
- **Forcible rape** —The carnal knowledge of a female forcibly and against her will. Rapes by force and attempts or assaults to rape, regardless of the age of the victim, are included. Statutory offenses (no force used —victim under age of consent) are excluded.
- **Robbery** —The taking or attempted taking of anything of value from the care, custody, or control of a person or persons by force or threat of force or violence and/or by putting the victim in fear.
- **Aggravated assault** —An unlawful attack by one person upon another for the purpose of inflicting severe or aggravated bodily injury. This type of assault usually is accompanied by the use of a weapon or by means likely to produce death or great bodily harm. Simple assaults are excluded.
- **Burglary (breaking or entering)** —The unlawful entry of a structure to commit a felony or a theft. Attempted forcible entry is included.
- **Larceny-theft (except motor vehicle theft)** —The unlawful taking, carrying, leading, or riding away of property from the possession or constructive possession of another. Examples are thefts of bicycles or automobile accessories, shoplifting, pocket-picking, or the stealing of any property or article that is not taken by force and violence or by fraud. Attempted larcenies are included. Embezzlement, confidence games, forgery, worthless checks, etc., are excluded.
- **Motor vehicle theft** —The theft or attempted theft of a motor vehicle. A motor vehicle is self-propelled and runs on land surface and not on rails. Motorboats, construction equipment, airplanes, and farming equipment are specifically excluded from this category.
- **Arson** —Any willful or malicious burning or attempt to burn, with or without intent to defraud, a dwelling house, public building, motor vehicle or aircraft, personal property of another, etc.

Landscape

